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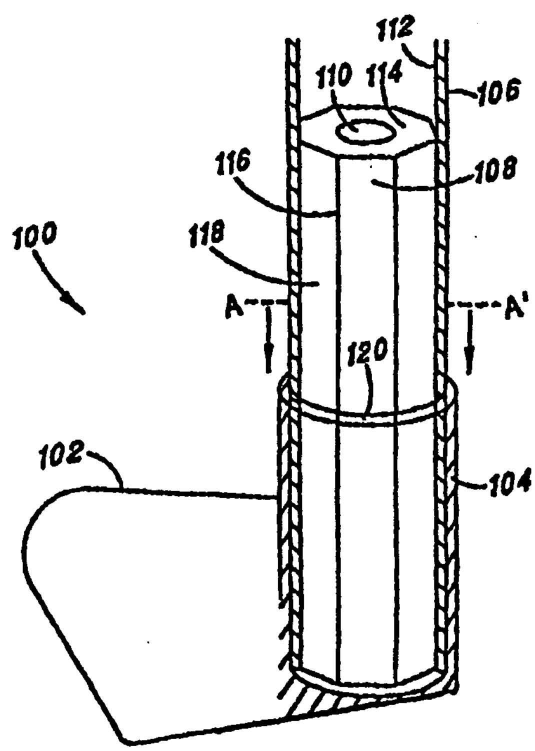
(54) Title: IMPROVED GOLF CLUB

(57) Abstract

A golf club shaft assembly, a golf club shaft insert, and a related method of providing a golf club, the golf club shaft assembly consists of a club shaft (106) and an insert (108) positioned within the club shaft (106) proximate to a club head end of the club shaft (106). The insert (108) comprises one or more contact portions (116) contacting an interior surface (304) of the club shaft (106) and one or more non-contact portions (118, 512), wherein each of the one or more non-contact portions (118, 512) do not contact the interior surface (304) of the club shaft (106). An exterior dimension of the insert (108) is less than or equal to an interior dimension of the club shaft (106), whereby the insert (108) reduces the torsional forces due to a club head (102) attached to the club head end of the club shaft (106) during use of a golf club (100), while not altering the designed load characteristics or kick point of the club shaft (106).



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IMPROVED GOLF CLUB

BACKGROUND OF THE INVENTION

The present invention relates to golf clubs, and more particularly to golf club shafts. Even more particularly, the present invention relates to an insert placed within a golf club shaft to reduce torque or twisting in a club head relative to the golf club shaft upon swinging the golf club and upon impact of a golf ball.

Golf is a very popular sport and the equipment used in golf has undergone many technological changes in recent years. Wood and steel club shafts have given way to graphite shafts. The modern graphite, or graphite composite shafted clubs have been designed to be rigid while retaining a desired flexibility. This flexibility gives the golf club a certain "looseness" so that it is not too "stiff" in the hands of the golfer. The flexibility gives the club shaft desired loading characteristics and a desired kick point. The kick point is the point in the shaft where the energy is loaded to the club head. The kick point and the loading characteristics may be varied to produce varying results (e.g. a lower kick point provides more loft of the ball upon impact) to make the most efficient use of the energy of the swing.

Torsional effects, or twisting effects have been known for years in golf clubs. As the club impacts the golf ball there is a slight twisting of the club head in relation to the club shaft. These torsional forces are amplified when a ball is hit other than in the middle portion or center of the club head. A hit on a toe or the end of a club head will physically cause more twisting than a hit in the center of the club head. Even a hit in the center of the club head will create torque, which, particularly in a graphite shafted golf club causes twisting because of the construction characteristics of the graphite shaft. Torque is also created when the club head itself comes into contact with the ground (hitting the ball "fat") prior to or simultaneously with contact of the ball. An "iron" (a club with an angled metal head) is designed to get "underneath" a ball resting on the ground; thus, making some contact with the ground. Most golf clubs will make some contact with the ground in normal use. In-experienced players will have more contact with the ground and more off center hits than an experienced player. Regardless of a player's skill level, twisting of the club head relative to shaft will still occur.

Furthermore, torsional forces resulting in a twisting of the club head relative to the club shaft are also generated due to the motion of the golfer swinging the club in a typical stroke. The center of mass of the club head is commonly off center from a central lengthwise axis extending through the club shaft. During the swing, the club head follows the club shaft and will tend to resist or drag slightly against the movement of the club shaft. Thus, as the golfer swings the golf club, a slight twisting occurs in the club head due to the motion and physics of the swing. This twisting is amplified with club shafts that are designed to have a certain flexibility. For example, a modern graphite club shaft or graphite composite club shaft may result in more torsional forces generated at the club head; and thus, a greater twisting of the club head, than steel or wood club shafts.

Additionally, the flexibility designed into the club shaft, e.g. in graphite club shafts, will affect the twisting at the club head. The more flexible a shaft is, the less stable the club head is, resulting in greater twisting in the club head. For example, a shaft with a higher kick point will generally have a more flexible lower portion of the shaft connected to a hosel and club head; thus, the club head will experience more twisting. The hosel is the portion of the club head that receives the club shaft. To correct this, a shaft can be made less flexible to remove some of the torsional effects by making the shaft out of a more rigid material; however, the designed loading characteristics and kick point of the golf club may be changed and the golf club may not hit a golf ball as effectively.

The results of these torsional forces or effects and the resulting twisting of the club head relative to the club shaft can be profound. A very slight change in the angle of the club head relative to the club shaft will unfavorably affect the accuracy of the shot. For example, even a slight twisting resulting in a few degrees or fractions of degrees difference of the club head relative to the club shaft on a golf ball hit several hundred meters will cause the golf ball to deviate a number of meters off center. This could mean the difference between the golf ball lying in the fairway or on the green and lying in the rough or in a sand trap. Therefore, a device is needed to reduce the torsional forces at the club head while retaining, or limiting the alteration of, the club shaft's specific flexibility characteristics.

SUMMARY OF THE INVENTION

The present invention advantageously addresses the needs above as well as other needs by providing an insert placed within a golf club shaft to reduce twisting in the club head relative to the golf club shaft upon swinging the golf club and upon impact of the golf ball, without significantly changing the desired load characteristics or the kick point of the club shaft.

In one embodiment, the present invention may be characterized as a golf club shaft assembly, and related method of providing a golf club, that comprises a club shaft and an insert positioned within the club shaft proximate to a club head end of the club shaft. The insert comprises one or more contact portions contacting an interior surface of the club shaft and one or more non-contact portions, wherein each of the one or more non-contact portions do not contact the interior surface of the club shaft. The insert reduces the torsional forces due to a club head attached to the club head end of the club shaft during use of the golf club. In a variation, an exterior dimension of the insert is less than or equal to an interior dimension of the club shaft.

In another embodiment, the present invention may be characterized as a golf club shaft insert comprising an insert adapted to be inserted into a club shaft proximate to a club head end of the club shaft. The insert has a length and includes one or more contact portions adapted to contact an interior surface of the club shaft and one or more non-contact portions adapted to not contact the interior surface of the club shaft. The insert is adapted to reduce the torsional forces due to a club head attached to the club head end of the club shaft during use of the golf club. An exterior dimension of

the insert is less than or equal to an interior dimension of the club shaft the insert is adapted to be inserted into.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other aspects, features and advantages of the present invention will be more apparent from the following more particular description thereof, presented in conjunction with the following drawings wherein:

FIG. 1 is a view of an improved golf club design in accordance with one embodiment of the present invention including a club shaft, a hosel, a club head and an insert;

FIG. 2 is a cross sectional end view of one variation of the insert of FIG. 1 which is fit inside the club shaft in accordance with an embodiment of the present invention;

FIG. 3A is a cross-sectional view of another variation of the insert of FIG. 1 that is fit inside the club shaft in accordance with another embodiment of the present invention;

FIG. 3B is a cross-sectional view of another variation of the insert of FIG. 1 including a channel, the insert being fit inside the club shaft in accordance with yet another embodiment of the present invention;

FIG. 4 is an isometric view of the insert of FIG. 2, adapted to fit within the club shaft in accordance with another embodiment of the present invention;

FIG. 5A is an isometric view of the insert of FIG. 3A, adapted to fit within the club shaft in accordance with an embodiment of the present invention;

FIG. 5B is a view of the insert of FIG. 3B including channels formed in the insert, such that the insert is adapted to fit within the club shaft in accordance with an embodiment of the present invention;

FIG. 5C is a lengthwise cross sectional view of the insert of FIGS. 3B and 5B illustrating the spacing between channels, in accordance with an embodiment of the present invention;

FIG. 6 is a cross-sectional view of a variation of insert as embodied in FIGS. 1-5C, in accordance with another embodiment of the present invention;

FIG. 7 is a cross-sectional view of another variation of the insert as embodied in FIGS. 1-5C, in accordance with further embodiment of the present invention;

FIG. 8 is a cross-sectional view of yet another variation of the insert as embodied in FIGS. 1-5C, in accordance with another further embodiment of the present invention;

FIG. 9 is a side view of the embodiment of the insert of FIG. 1, inserted into a borethrough hosel in accordance with an additional embodiment of the present invention;

FIG. 10 is a longitudinal sectional view of the insert and the borethrough hosel embodied in FIG. 9;

FIG. 11 is a side view of the embodiment of the insert of FIG. 1, inserted into a fixed end hosel in accordance with another additional embodiment of the present invention;

FIG. 12 is a longitudinal sectional view of the insert and the fixed end hosel embodied in FIG. 11; and

FIG. 13 is a cross-sectional view of the insert of FIG. 1, in accordance with yet another embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The following description of the presently contemplated best mode of practicing the invention is not to be taken in a limiting sense, but is made merely for the purpose of describing the general principles of the invention. The scope of the invention should be determined with reference to the claims.

Referring first to FIG. 1, a view of an improved golf club design in accordance with an embodiment of the present invention is shown. The improved golf club 100 comprises a club head 102 with a hosel 104, a club shaft 106 having an interior surface 112, and an insert 108 having a core 110. The insert 108 also has an octagonal cross-section 114, a plurality of edges 116 (also referred to generically as a plurality of contact portions) and a plurality of faces or facets 118 (also referred to generically as a plurality of non-contact portions).

The insert 108, or "tip section stabilizer", reduces the torsional effects experienced at the club head 102 relative to the club shaft 106 without sacrificing the specific load characteristics and kick point of the club shaft 106. The insert 108 allows the club shaft 106 to retain the desired flexibility and at the same time, stabilize the club head 102 without making the golf club 100 "stiff".

The insert 108 is formed with a core 110 that is comprised of a metal. The core 110 is typically a metal wire or metal composite wire having a diameter and extending at least a portion of the length of the insert 108, i.e. extending the entire length of the insert 108; however, the core 110 may have a variety of shapes and thicknesses within the insert 108. The core 110 is preferably comprised of titanium, but could be comprised of other metals, such as tungsten or copper. The core 110 is then clad or covered with a non-abrading, flexible polymer material. The insert 108 can be made of a plastic, rubber, or another suitable polymer material. Preferably, the insert 108 is composed of a non-abrading, flexible plastic. In other embodiments described further below with reference to FIGS. 2 through 5C, the insert 108 may not include a core 110, or the insert 108 may be entirely made of a metal or a metal alloy, preferably a metal with a torsional stiffness and desired lengthwise flexibility, e.g. titanium or a titanium alloy.

In the embodiment shown, the insert 108 has been molded to form an octagonal cross-section 114. The points of the octagon form a plurality of edges 116 extending at least a portion of the length of the insert 108, e.g., extending the entire length of the insert 108 as shown. The sides of the octagon form a plurality of facets 118 extending at least a portion of the length of the insert 108, e.g.. extending the entire length of the insert 108 as shown. For example, the plurality of edges 116 and/or the plurality of faces 118 may extend overall to cover over 25% of the length of the insert 108,

preferably over 50% of the length of the insert 108, more preferably over 75% of the length of the insert 108, and most preferably over 90% of the length of the insert 108.

However, the insert 108 could be designed to have a cross-section with any number of faces 118 and edges 116. Additionally, the edges 116 do not have to be in the form of straight edges, but may be rounded, and the faces 118 do not have to be straight extending from each edge, but may be curved in an irregular shape or in a regular shape, e.g. a concave curve from edge 116 to edge 116. In fact, the insert 108 of this and other embodiments does not have to have faces 118 or edges 116 at all, but simply portions of the insert 108 that make contact with an interior surface 112 of the club shaft 106 (i.e. contact portions) and portions of the insert 108 that do not make contact with the interior surface 112 of the club shaft 106 (i.e. non-contact portions). The portions making contact and the portions not making contact could be of many different shapes and sizes depending on the design. For example, the contact portions may be rounded instead of edges. Alternatively, instead of an octagonal cross section including edges and faces, the contact portions may actually conform to the shape of the interior surface of the club shaft for a portion of the length around perimeter of the insert in a cross section view, i.e. the contact portions may be "arcs" extending a portion of the way around the perimeter of the insert and concentric with and contacting the interior surface of the club shaft at those portions of the perimeter of the insert, while the non-contact portions would be breaks (which could be faces or even groove-like portions) in the contact portions around the perimeter of the insert. However, in preferred embodiments, the surface area of the interior surface 112 of the club shaft 106 that "contacts" the insert 108 should be less than the surface area of the interior surface 112 of the club shaft 106 that does not "contact" the insert 108. It is noted in other embodiments, the surface area of the interior surface 112 of the club shaft 106 that "contacts" the insert 108 may be more than the surface area of the interior surface 112 of the club shaft 106 that does not "contact" the insert 108.

Since the insert 108 does not make contact with the interior surface 112 of the club shaft 106 at all points and the portion of the insert 108 that makes contact with the interior surface 112 is flexible, the insert 108 will accommodate the normal lengthwise flex of the club shaft 106. This feature is particularly advantageous because it enables the club shaft 106 to retain the load characteristics and kick point that the shaft 106 was designed to have.

Furthermore, the intermittent contact of the insert 108 with the interior surface 112 of the club shaft 106 along the length of the insert 108 advantageously reduces the torque in the club head 102 or stabilizes the club head 102 without sacrificing the performance of the club shaft 106. There is enough contact with the interior surface of the club shaft 106 to give the proper amount of support in a radial direction about the central axis extending the length of the club shaft 106, but not enough contact with the interior surface 112 of the club shaft 106 to interfere with the overall flexibility of the club shaft 106.

Alternatively, for example, if the exterior of the insert 108 made complete contact with the interior surface 112 of the club shaft 106, and in particular complete contact throughout the length of the insert, i.e. the exterior dimension of the insert was flush with (or conforms to) the interior

surface of the club shaft 106, then the torsional effects at the club head 102 would be reduced. However, the load characteristics and kick point of the club shaft 106 would be altered and the golf club 100 would not hit the ball as effectively, or as designed. Additionally, the golf club 100 would feel "stiff" to the golfer. This embodiment seeks to stabilize the club head 102 while retaining the designed specifications particular to a graphite club shaft, especially in club shafts comprising graphite.

Furthermore, the insert 108 is located at or near the end of the club shaft 106 that is fit within the hosel 104, e.g. proximate to the "club head end" of the club shaft. At this location, the insert 108 supports the shaft 106 and stabilizes the club head 102 at the critical portion, i.e. the tip portion of the club shaft. If the insert 108 extends too far up the length of the club shaft 106 it will affect the loading characteristics and the kick point of the club shaft 106. The length of the insert 108 varies depending on the embodiment (see FIG. 2 through FIG. 5C); however, preferably the insert 108 extends within the club shaft 106 both above and below the end of the hosel 104 where the club shaft 106 enters the hosel 104, regardless of whether the insert 108 is positioned at the end of the club head end of the club shaft or proximate to the club head end of the club shaft.

This embodiment is not designed to reduce gross torsional effects at the club head 102, such as a torsional force that might cause the club head 102 to detach from the club shaft 106. The present embodiment also will not prevent strong vibrational forces caused by hitting the ground too hard. The club shaft 106 and the hosel 104 themselves are designed to reduce such gross torque and prevent the club head from detaching, at least within the expected, normal use of the golf club 100. This embodiment, as well as the other embodiments disclosed, is designed to "fine tune" the torsional forces seen at the club head 102. The insert 108 is designed to reduce even the slightest torque present. Thus, the insert 108 maximizes the performance of the golf club 100, in particular graphite shafted golf clubs or other golf clubs having club shafts that are designed to have a certain level of flexibility (i.e. loading characteristics and kick point). Thus, the insert 108 operates to reduce the unwanted torque generated with the normal use of the golf club 100. Even a slight club head 102 twisting of a few degrees relative to the club shaft 106 will have a significant difference in the directional trajectory of the golf ball, causing the golf ball to deviate many yards off center.

The insert 108 is fit snugly within the club shaft 106 and, depending on the specific embodiment, is located proximate to, i.e. at or near, the end of the club shaft 106 that is fit within the hosel 104 (i.e. the club head end of the club shaft). The insert 108 may be secured to the interior surface 112 of the shaft 106 or the bottom of the hosel 104 with adhesives as discussed further below. The insert 108 fits within the hosel 104 and extends above the point 120 where the shaft 106 enters into the hosel 104. Thus, whether or not the insert 108 is positioned at the club head end or near the club head end of the club shaft, in preferred embodiments, the insert 108 should extend both above and below the point 120 where the shaft 106 enters into the hosel 104. The specific dimensions, composition and characteristics of variations of the insert 108 are further discussed with reference to FIG. 2 through FIG. 8. As shown, the hosel 104 may be a "borethrough" hosel, but may also be a "fixed end" hosel, by way of example (see FIG. 9 through FIG. 12).

The club head 102 may be any of a variety of club heads known in the art. For example, the club head 102 may be a "driver", "iron", or "wood" to name a few. The iron style club head typically makes some contact with the ground, so the torsional forces at the club head 102 may be greater than a driver, which often makes contact with the golf ball sitting above the ground on a tee. However, both types of club heads will still experience twisting during impact with the golf ball due to the characteristics of the graphite golf club shaft and depending on the location of the hit to the club head. All three types of club heads will further experience torsional forces at the club head due to the swinging motion since the center of mass of the club head 102 is off center from a lengthwise central axis of the club shaft. Further details and embodiments of the insert 108 are discussed below.

Referring next to FIG. 2, a cross-sectional view of an insert fit inside a club shaft in accordance with one embodiment of the present invention is shown. The cross-sectional view 200 is a view taken at line A-A′ in FIG 1. The "tip section stabilizer" or insert 208 containing a core 210 is fit within a club shaft 202 having an interior surface 204. Spaces 206 are created between the exterior of the insert 208 and the interior surface 204 of the club shaft 202. The combination of the insert 208, of this and other embodiments, fit within the club shaft may be referred to as a "golf club shaft assembly".

The embodiment shown has a core 210 comprised of a metal, preferably titanium, that extends at least a portion of the length of the insert 208, e.g. extends the entire length of the insert. The core 210 is covered by the insert 208 which is made of a flexible polymer material. The insert 208 has an octagonal cross-section such that the points of the octagon make contact with the interior surface 204 of the club shaft 202, i.e. forming the edges (which are an embodiment of contact portions) of the insert 208. The faces (an embodiment of the non-contact portions) of the octagonal cross-section create spaces 206 between the interior surface 204 of the club shaft 202 and the individual faces. The part of the octagonal cross-section (e.g. the faces or facets) that creates these spaces 206 can be referred to as non-contact portions of the insert 208. As stated, above the spaces 206 are advantageous of the present embodiment. The spaces 206 enable the shaft to retain the desired loading characteristics and kick point.

Typically, a graphite shaft has an interior diameter at the end of anywhere between .851 cm and .940 cm and a weight between 50 grams to 110 grams. The most common golf clubs have a weight between 60 and 80 grams. The distance between opposite points on the octagonal cross-section should be about the same dimension as the diameter of the interior surface 204 of the shaft 202 (e.g. the exterior dimension of the insert 208 should be less than or equal to an interior dimension or interior diameter of the club shaft if the club shaft is cylindrical), preferably about 2.54 mm less than the diameter of the interior surface 204 of the club shaft 202. The diameter of the core 210 can vary, but is preferably half of the diameter of the insert 208. For example, if the diameter of the interior surface 204 of a graphite shaft is .851 cm, then the dimension of the insert should be .848 cm between points of the octagon. The diameter of the core 210 should be .444 cm. The preferred weight of the insert 208 is about 10-12 grams. The preferred length of the insert 208 ranges from 5.1-10.1 cm depending on the design of the club shaft 202.

The club shaft 202 may be graphite, graphite composite or made from another suitable material. This embodiment is most effective with a club shaft 202 has certain desired flexibility characteristics and torsional forces are present at the club head due to swinging the club and contacting the ball and/or ground. The modern graphite shaft is typically hollow through the entire length, although this embodiment is still effective if the club shaft 202 is only partially hollow. Additionally, in another embodiment, the insert 208 is tapered for a club shaft 202 that has a tapered interior running from end to end. However, most graphite shafts have a uniform interior cross-section extending the length of the graphite shaft.

Referring next to FIG. 3A, a cross-sectional view 300 of another variation of the insert of FIG. 1 is shown which is fit inside a club shaft in accordance with another embodiment of the present invention. The insert 308 is fit within a club shaft 302 having an interior surface 304. Spaces 306 are formed between the interior surface 304 of the club shaft 302 and each face or facet of the insert 308.

This embodiment of the insert 308 does not include a core. The insert 308 is a solid insert comprised of a flexible polymer material. The insert 308 has the same exterior cross-section (thus, same exterior dimension) as the embodiment shown in FIG. 2. The only difference is the lack of a core within the insert 308. Since the core is not present, the insert 308 is typically made longer than the insert containing a core. The insert 308 in the embodiment shown will typically be about 10.1-12.7 cm long compared to an insert about 5.1-7.6 cm long shown in FIG 2. The insert 308 will weigh about 5-7 grams without the core compared to 10-12 grams with the core. The core adds a rigidity to the insert so that the insert may be made shorter in length. Without the core present, the insert 308 is preferably made longer to provide the same effect of reducing twisting or torque at the club head due use of the golf club. The insert 308 makes contact with the interior surface 304 of the shaft 302 at the points of the octagon, e.g. the contact portions (shown in cross section). Spaces 306 are advantageously created between the faces, e.g. the non-contact portions (shown in cross section), of the octagon and the interior surface 304 of the golf club shaft 302.

The insert 308 of FIG. 3A may alternatively be comprised of a metal, such as titanium, tungsten, aluminum or copper, or a metal alloy comprising one or more of the mentioned metals, for example. Such a metallic insert, comprised of the recited metals, for example, will be more rigid than the embodiment comprised of a flexible polymer material, such as rubber, but will also have a certain level of flexibility that is specifically inherent to the given metal or metal alloy. However, the length of the insert is shortened in comparison to an insert comprises a flexible polymer material, such that the insert does not make the club shaft too stiff. Thus, the metallic insert will provide torsional support at the club head and not limit the normal lengthwise flexibility of the club shaft due to an inherent flexibility of these metals. Thus, advantageously, the insert 308 may be made entirely of a metal or metal alloy and will mitigate the torsional forces at the club head relative to the club shaft without altering the desired load characteristics and kick point of the club shaft.

Referring next to FIG. 3B, a cross-sectional view of another variation of the insert of FIG. 1 including a channel is shown such that the insert is fit inside a club shaft in accordance with yet another embodiment of the present invention. Again, the insert 308 is fit within a club shaft 302 having an interior surface 304. Spaces 306 are formed between the interior surface 304 of the club shaft 302 and each face 307 or facet (also referred to as non-contact portion 307) of the insert 308. Furthermore, the edges 309 (or contact portions 309) of the insert 308 are shown as the points of the cross-section of the insert 308, which is shown as an octagonal cross-section. Additionally, this embodiment illustrates a channel 312 that is formed about the exterior surface of the insert 308. The channel 312 is also an embodiment of a non-contact portion, and thus is referred to generically also as a non-contact portion, similar to the faces as described above.

In this embodiment of the insert 308, a channel 312 (an embodiment of a non-contact portion and also referred to a groove or a notch) is formed that extends annularly around at least a portion of the exterior surface of the insert 308, i.e. extends around the entire exterior surface of the insert 308. Furthermore, this channel 312 is indicated as extending into the exterior surface of the insert 308 and terminating at the indicated dashed lines, such that the channel 312 or groove is formed within the contact portions (e.g. edges 309) and the other non-contact portions (e.g. faces 307) around the exterior surface of the insert 308. Furthermore, note that the cross section of the insert 308 at the channel is circular (at the dashed line): however, the cross section may be designed to be circular, oblong, the same exterior cross section as the rest of the insert (e.g. octagonal), or any other desirable geometry which may be used to control or fine tune the lengthwise flexibility of the insert 308, which allows for the control of the load characteristics of the club shaft 302. Thus, the cross-section of the insert 308 may be further controlled at a respective channel 312.

Although FIG. 3B illustrates one channel 312, there may be many channels at different cross sections along the length of the insert 308, which is illustrated and described with reference to FIGS. 5B and 5C. Additionally, the channels may extend only part way around the exterior surface of the insert 308, e.g. forming semi-circles at a particular cross section of the insert 308.

The embodiment of the insert 308 of FIG. 3B may be comprised of a flexible material, such as a polymer, as described above with the channel 312 being formed or cut within the exterior surface of the insert 308.

Alternatively, the embodiment of the insert 308 of FIG. 3B, as well as the embodiment of FIG. 3A, may also be completely comprised of a metal, such as titanium, tungsten or copper, or a metal alloy, as described above. The significance of the composition of the insert 308 and the channel 312 or channels is further described with reference to FIGS. 5B-5C.

Referring next to FIG. 4, a view of an embodiment of the insert of FIG. 2 is shown which is adapted to fit within a club shaft in accordance with a further embodiment. The insert 400 has an octagonal cross-section 404, a core 402 extending the length of the insert 400, a plurality of edges

(an embodiment of contact portions) 406 extending the length of the insert 400, and a plurality of facets 408 (an embodiment of non-contact portions) extending the length of the insert 400.

The insert 400 is consistent with that shown in FIG. 1 and FIG. 2. The length of the insert 400 will typically be 5.1-7.6 cm depending on the club shaft, and the flexibility of the insert 400 and core 402 used. The presence of the core 402 as compared to the previous embodiment gives the insert 400 an added rigidity; thus, a shorter length yields a similar overall effect in reducing the torsional effects at the club head.

Referring next to FIG. 5A, a view of an embodiment of the insert of FIG. 3A is shown which is adapted to fit within a club shaft in accordance with an additional embodiment. The insert 500 has an octagonal cross-section 502, a plurality of edges 504 extending the length of the insert 500, and a plurality of facets 506 extending the length of the insert 500. The embodiment of the insert 500 is similar to the embodiment shown in FIG. 2 and FIG. 4, except there is no core. The insert 500 is entirely made of a flexible polymer material. The length of the insert 500 is typically 10.1-12.7 cm compared to an insert that has a core, where the insert is 5.1-7.6 cm long. If the insert 500 is longer, it may interfere with the loading characteristics and kick point of the shaft.

Furthermore, an embodiment of the insert 500 made entirely of metal or a metal alloy is typically made shorter than the insert made of a flexible polymer material and likely shorter than an insert including a core (as shown in FIG. 4). For example, such a metallic or metal alloy insert 500 may be about 2.54-7.6 cm (or 2.54-5.1 cm) long depending on the metal or metal alloy used, but is not limited to such lengths.

Referring next to FIG. 5B, a view of an embodiment of the insert of FIG. 3B including channels formed in the insert is shown such that the insert is adapted to fit within a club shaft in accordance with an embodiment of the present invention. This embodiment of the insert 510 has an octagonal cross-section 502, a plurality of edges 504 (i.e. an embodiment of contact portions) generally extending the length of the insert 510, a plurality of faces or facets 506 (i.e. an embodiment of non-contact portions) generally extending the length of the insert 510, and channels 512 (i.e. another embodiment of non-contact portions and also referred to as grooves or notches) formed around the exterior surface of the insert 510. This embodiment of the insert 510 is similar to the embodiment shown in FIG. 2 and FIG. 4, except there is no core and the addition of channels 512, and similar to the embodiment shown in FIG. 5A, except with the addition of channels 512.

In this embodiment of the insert 510, each channel 512 (also referred to as a groove or notch) extends about, or annularly around, at least a portion of the exterior surface (or circumference) of the insert 308, e.g., completely around the exterior surface of the insert 308 as shown. Note that the channel 512 is also a non-contact portion of the insert 510, since the exterior surface of the insert 510 at the channel 512 does not contact the interior surface of the insert 510. As such, each channel 512 is formed within the exterior surface of the insert 512, e.g. formed within respective ones of the plurality of edges 504 (i.e. an embodiment of contact portions) and respective ones of the plurality of facets 506 (i.e. an embodiment of non-contact portions) around the exterior

surface of the insert 510. Furthermore, the channels 512 extend at least a portion of the length of the insert 510, for example, each channel 512 extends less than 20% of the length of the insert 510, preferably less than 10% of the lenght of the insert, and more preferably less than 5% of the length of the insert 510. Preferably, each channel 512 extends annularly around at least a portion of the exterior surface of the insert at a right angle to a lengthwise axis extending the length of the insert 510, i.e. if the insert 510 is positioned as standing vertically, each channel extends annularly in a horizontal direction around the exterior surface of the insert 510. However, in other embodiments, one or more channels may extend annularly around the insert in a diagonal fashion or offset from a horizontal direction, i.e. not at a right angle with respect to the lengthwise axis extending the length of the insert 510. Furthermore, as shown, each of the channels 512 are spaced apart from each other and are located a different position along the length of the insert 510. In an alternative embodiment, one or more channels may be formed that extend annularly about the insert in a helical manner (spiraling) throughout at least a portion of the length of the insert. Furthermore, in other embodiments, the channels may extend part way about the exterior surface of the insert 510 such that each channel 510 is a semi-circle, for example, that extends half way around the insert 510 at different positions along the length of the insert 510.

Typically, the channels 512 serve the purpose of adding an additional lengthwise flexibility to the insert 510 so that a longer insert 510 may be used. Generally, the longer the insert 510, the more the torsional forces at the club head will be reduced; however, if the insert 510 is too long, the lengthwise flexibility of the club shaft is effected. Thus, the channels 512 generally improve the performance of the club by allowing the insert 510 to have an adequate length to stabilize the club head and desired lengthwise flexibility so that the lengthwise flexibility and load characteristics of the club shaft is not inhibited. The geometry of these channels can be designed (tailored) for the most effective performance in a variety of shaft materials, stiffnesses and kick points. As such, the channels 512 serve to break the continuity of the contact portions, e.g. plurality of edges 504, that contact the interior surface of the club shaft. Thus, while providing the additional torsional support at the club head, the insert is more flexible to lengthwise bending of the club shaft.

The insert 510 of FIG. 5B may be comprised of a flexible material, such as a polymer, as described above with the channel 512 being formed or cut within the exterior surface of the insert 510. Alternatively, the insert 510 of FIG. 5B may be comprised of a metal, such as titanium, tungsten or copper, or a metal alloy, comprising one of the above mentioned metals.

It has been found that in the embodiments of the insert 308 that are substantially completely comprised of a metal or metal alloy, the addition of one or more channels 312 spaced at different positions throughout the length of the insert 510 advantageously gives the metallic insert 510 an added controllable flexibility to the lengthwise flex of the club shaft, in addition to the enhanced rigidity and torsional support at the club head. Thus, a metallic insert may be used in conjunction with a specifically designed club shaft having a specific kick point and load characteristics, to reduce the twisting or torsional forces at the club head due to swinging the golf club and/or due to impact of the

club head with the ball without altering the designed kick point and load characteristics of the club shaft.

Furthermore, with the addition of channels 512, an embodiment of the metallic insert or a polymer insert may be designed slightly longer than a corresponding metallic insert without channels having a similar composition due to the added flexibility of the insert created by the channels 512 to accommodate the lengthwise flexes of the club shaft.

Additionally, the spacing of the channels 512 throughout the length of the insert 510 may be altered or adjusted to produce desired results, as described further with reference to FIG. 5C.

The insert 510 may be friction fit into the club shaft or may be adhered within the club shaft using an adhesive, such has epoxy. For example, the insert 510 is coated with an adhesive and inserted into the club shaft to the desired location and the adhesive is allowed to dry.

In an alternative embodiment of the insert of FIG. 5B, the non-contact portions may be embodied only as the channels 512 such that there are no faces 506 formed in the insert. Thus, the contact portions, previously shown in FIG. 5B as edges 504 would be embodied as the exterior surface of the insert between the channels 512 spaced along the length of the insert. As such, the insert would resemble a cylindrical shaped insert having channels formed intermittently throughout the length of the insert and annularly extending around at least a portion of the exterior surface of the insert and spaced intermittently along the length, e.g. a cylinder having channels resembling rings spaced throughout the length of the insert. In such an embodiment, the non-contact portions are the channels 512 and the contact portions are the exterior perimeter surface of the insert in between the channels 512.

Referring next to FIG. 5C, a lengthwise cross sectional view of the insert of FIGS. 3B and 5B is shown illustrating the spacing between channels in accordance with an embodiment of the present invention. Shown are the insert 510 having edges 504 (an embodiment of contact portions) and channels 512 (an embodiment of non-contact portions). The channels 512 are spaced at different locations along the length of the insert 510. Again, the channels allow the insert 510 to be more flexible to the desired lengthwise flex (shown as arrow "A") that is designed into most club shafts, in particular graphite shafted clubs which are commonly designed with a desired kick point and load characteristics.

The channels 512 may be evenly spaced or spaced further apart or closer together throughout different portions of the length of the insert 510. A club shaft having a specific kick point and load characteristics may be altered or adjusted by the proper spacing of the channels. For example, the insert 510 may be made long enough to effect the flexibility of the club shaft and then channels are added to create more or less lengthwise flexibility in the insert 510 at certain points along the insert 510. Thus, with the proper placement of channels 512 and proper shape and cross-section, the kick point and load characteristics of the club shaft may be fine-tuned. For example, if more flexibility is desired at one end of the insert 510, then more channels 512 may be formed near the one end of the insert 510. Furthermore, altering the depth of the channels 512 or the cross section geometry (as

shown in FIG. 3B) of the channels 512 will alter the flexibility of the insert at the specific channels 512.

It is noted that the channels 512 are shown are being cut into the exterior surface of the insert 510 as a square cut indentation; however, this channel may be other shapes, such as rounded, trapezoidal or triangular. The specific shape of the channel may be altered to control the specific lengthwise flexibility of the insert which is used to control or optimize the effect on the load characteristics of the club shaft.

Referring next to FIG. 6, a cross-sectional view 600 is shown of a variation of the insert as embodied in FIGS. 1-5C. The insert 602 has a hexagonal cross-section. The points 610 (i.e. the cross sectional view of the edges or contact portions) of the hexagon make contact with the interior surface 606 of the club shaft 604. Spaces 608 are formed between the sides 612 (i.e. the cross section view of the faces or non-contact portions) of the hexagonal cross-section and the interior surface 606. This embodiment of the insert 602 could optionally have a core as described above, or be comprised of a flexible polymer material, or entirely of a metal or metal alloy.

An important feature shown of this embodiment and the following embodiments in FIG. 7 and FIG. 8, as well as the previous embodiments of FIGS. 1-5C, is not only the specific geometric shape of the cross-section, but the fact that there are contact portions (i.e. the points 610) of the insert 602 that make contact with the interior surface 606 and there are non-contact portions (i.e. the sides 612) of the insert 602 that do not make contact with the interior surface 606. The contact portions add to the stability of the club head to reduce the torsional or twisting effects, while the non-contact portions enable the shaft 604 to retain its designed flexibility, load characteristics, and kick point. The contact portions are not limited to points 610 and edges extending the length of the insert 602. Nor are the non-contact portions limited to sides 612 and facets extending the length of the insert 602. The insert 602 could be designed to have many differently shaped contact portions and non-contact portions having straight or curved dimensions. For example, the sides 612 do not have to be of equal length or could be rounded so as not to resemble the sides 612 or points 610. Furthermore, the contact portions may conform to (or be flush with or concentric with) the interior surface of the club shaft 604 for a portion of the perimeter of the insert 602. Thus, the contact portions might be arcs concentric with and contacting the interior surface of the club shaft, while being broken up by non-contact portions formed in between these "arc" embodiments of the contact portions. These non-contact portions may actually be groove-like extending along at least a portion of the length of the insert, e.g. extending the entire length of the insert. Thus, the insert 602 might appear as a cylindrical insert having non-contacts portions, such as faces, curved faces or grooves extending the length of the insert. In this embodiment, the contact portions are the portions in between the non-contact portions that are concentric with the interior surface of the club shaft Further alternatively, as described above, the cross section of FIG. 6 may be circular (i.e the contact portion is the exterior surface of the insert at the particular cross section) and the non-contact portions are one or more channels as described above and would be visible at another cross section.

Additionally, the contact portions and non-contact portions do not need to extend uniformly throughout the length of the insert 602, or throughout the entire length of the insert 602. Thus, the insert 602 includes contact portions (e.g. points 610 and edges) that contact (i.e. mechanically engage) the interior surface 606 of the club shaft 604 throughout at least a portion of the length of the insert 602 and there are non-contact portions that do not contact the interior surface 606 of the club shaft 604 throughout at least a portion of the length of the insert 602.

Referring next to FIG. 7, a cross-sectional view 700 of another variation of the insert as embodied in FIGS. 1-5C is shown. The insert 702 within a club shaft 704 has a cross-section having four sides or a square. Similarly, this embodiment could optionally have a core as described above.

Referring next to FIG. 8, a cross-sectional view 800 of another variation of the insert as embodied in FIGS. 1-5C is shown. The insert 802 within a club shaft 804 has a cross-section having three sides or a triangle. Similarly, this embodiment could optionally have a core as described above.

Referring next to FIG. 9, a view is shown of an embodiment of the insert of FIG. 1 inserted into a borethrough hosel. The club head 902 having a borethrough hosel 904 has a club shaft 906 fit inside the borethough hosel 904. The insert 908 fits within the club shaft 906 proximate to (i.e at or near) the club head end of the club shaft 906 (i.e. shown as being at the end of the club head end of the club shaft 906) and has a core 910 and an octagonal cross-section 912. Thus, the golf club shaft assembly, i.e. the insert 908 and club shaft 906) fit within the borethrough hosel 904. The borethough hosel 904 extends entirely through the club head 902. The club shaft 906 is secured all the way inside the bare-through hosel 904, typically with epoxy, and the insert 908 is friction fit at the bottom of the club shaft 906, or attached within the club shaft 906 at an interior surface of the club shaft 906 with an adhesive. The insert 908 extends both above and below the point where the club shaft 906 exits the borethrough hosel 904, but not the entire length of the club shaft 906. It is noted that the insert 908 described in FIG. 9 and also in FIGS. 10-13 may be consistent with any of the embodiments as described with reference to FIGS. 2-8.

Referring next to FIG. 10, a longitudinal sectional view is shown of the insert and the borethrough hosel as embodied in FIG. 9. The longitudinal view 1000 is taken from the line B-B′ in FIG. 9. A club head 1002 having a borethrough hosel 1004 has a club shaft 1006 having an interior surface 1016 fit within. An insert 1008 having a core 1010 is fit within the club shaft 1006. Also shown is a layer of epoxy 1012 and a thin cap 1014.

The insert 1008 is typically inserted, e.g. friction fit, within the club shaft 1006 proximate to (i.e. at or near) the club head end of the club shaft 1006 such that it extends above the point where the graphite or club shaft 1006 enters the borethrough hosel 1004. The diameter (or exterior dimension) of the insert 1008 is about the same as or less than an interior diameter of the insert 1008, such that the insert 1008 can be pushed into the club shaft 1006, but typically won't slide out of club shaft 1006 on its own. The insert 1008 may be coated with an adhesive, such as epoxy, prior to

being inserted into the club shaft 1006, such that the insert 1008 adheres to the interior surface 1016 of the club shaft 1006 at the contact portions. The cross-section of the insert 1008 is taken at the exterior dimension of the insert, i.e. at the points of the octagon, such that the spaces created between the insert 1008 and the interior surface 1016 of the club shaft 1006 are not shown. The, the club shaft 1006 and insert 1008, i.e. the golf club shaft assembly, is secured into the borethrough hosel 1004 with a layer of epoxy 1012. Alternatively, the insert 1008 may be inserted into the club shaft 1006 after the club shaft 1006 is inserted into the hosel 1004. In addition, a thin cap 1014 may be placed over the bottom of the borethrough hosel 104 to protect the club shaft 1006 and the insert 1008.

Referring next to FIG. 11, a view 1100 is shown of an embodiment of the insert of FIG. 1, inserted into a fixed end hosel. The club head 1102 having a fixed end hosel 1104 has a club shaft 1106 fit inside the fixed end hosel 1104, typically with an adhesive, such as epoxy. The insert 1108 is fit within the club shaft 1106 proximate to the club head end of the club shaft 1106, i.e. shown as being at the club head end of the club shaft 1106, and has a core 1110 and an octagonal cross-section. The fixed end hosel 1104 extends part of the way through the club head 1102 and terminates at an end within the hosel. Typically, the insert 1108 is secured within the club shaft 1106, forming the golf club shaft assembly, and then the club shaft is secured within the fixed end hosel 1104. The insert 1108 extends above and below the point where the club shaft 1106 exits the fixed end hosel 1104. The present embodiment is not limited to the a borethrough hosel or a fixed end hosel, as the insert 1108 could be adapted to fit a variety of hosel designs known in the art. Furthermore, it is noted that the insert 1108 may be consistent with one or the embodiments as described with reference to FIGS. 2-8.

Referring next to FIG. 12, a longitudinal sectional view is shown of the insert and the fixed end hosel as embodied in FIG. 11. The longitudinal view 1200 is taken from the line C-C′ in FIG. 11. An insert 1208 having a core 1210 is fit within a club shaft 1206 proximate to, i.e. at or near, the club head end of the club shaft 1206; thus, forming a golf club shaft assembly. A club head 1202 having a fixed end hosel 1204 has the club shaft 1206 and the insert 1208 fit within the fixed end hosel 1204. Also shown is a shaft-hosel layer of epoxy 1214 between the club shaft 1206 and the hosel 1204, and an insert-hosel layer of epoxy 1216 between one end of the insert and the fixed end hosel 1204.

The insert 1208 is friction fit within the club shaft 1206 proximate to the club head end of the club shaft 1206 such that it extends above and below the point where the golf club shaft 1206 enters the fixed end hosel 1204. The insert may be coated with an adhesive, such as an epoxy prior to being inserted into the club shaft; thus, the insert is also adhered to the interior surface 1212 of the club shaft 1206 at the contact portions. Then the club shaft 1206 including the insert 1208 is secured into the fixed end hosel 1204 with a shaft-hosel layer of epoxy 1214. The insert 1208 may also then be secured at one end to the bottom of the fixed end hosel 1204 with an insert-hosel layer of epoxy 1216. It is noted that the insert 1208 may be placed into the club shaft 1206 after the club shaft 1206 is secured into the fixed end hosel 1204. The cross-section of the insert 1208 is taken at the

exterior dimension of the insert 1208, i.e. at the points of the octagon, such that the spaces created between the insert 1208 and the interior surface 1212 of the club shaft 1206 are not shown in FIG. 10.

Referring next to FIG. 13, a cross-sectional view 1300 of the insert of FIG. 1 is shown, in accordance with yet another embodiment of the present invention. The club shaft 1302 has an interior surface 1304. The insert 1306 having an octagonal cross-section and a core 1310 is fit within the club shaft 1302. The spaces formed between the interior surface 1304 of the club shaft 1302 and the insert 1306 (at the faces which are embodiments of non-contact portions) are taken up by a layer of very flexible epoxy 1308 poured therein. The flexible layer of epoxy 1308 is more flexible than the insert, even the insert comprising a flexible polymer material. The epoxy 1308 is flexible enough to not effect the load characteristics or the kick point of the club shaft 1302, which is a feature of this embodiment, yet the epoxy 1308 provides an adequate adhesive for securing the insert 1306 to the interior surface 1304 of the club shaft 1302.

Alternatively, in another embodiment, an adhesive is applied to the exterior surface of the insert 1302 prior to being inserted into the club shaft 1302. The adhesive is applied at only the contact portions (e.g. edges) or at both the contact portions and the non-contact portions (e.g. faces or facets). The adhesive is allowed to dry such that the insert is adhered to the interior surface 1304 of the club shaft 1302 at the contact portions. In this embodiment, spaces still exist between the interior surface 1304 and the non-contact portions, depending on the level of adhesive applied. Additionally, it is noted that the insert 1306 may also be embodied such as described with reference to FIGS. 2-8.

In accordance with at least several embodiments as further described above, a golf club shaft assembly is described as including a club shaft and an insert positioned within the club shaft, the insert comprising one or more contact portions contacting an interior surface of the club shaft and one or more non-contact portions, wherein each of the one or more non-contact portions do not contact the interior surface of the club shaft. An exterior dimension of the insert is less than or equal to an interior dimension of the club shaft, such that the insert reduces the torsional forces due to a club head attached to the club head end of the club shaft during use of the golf club. In a variation, the insert is located proximate to a club head end of the club shaft. In another variation, the insert comprises a flexible polymer. In a further variation, the insert comprises a metal or a metal alloy.

Furthermore, in accordance with at least several embodiments as further described above, a golf club shaft assembly is described as comprising a club shaft and an insert positioned within the club shaft proximate to a club head end of the club shaft, the insert comprising one or more contact portions contacting an interior surface of the club shaft and one or more non-contact portions, wherein each of the one or more non-contact portions do not contact the interior surface of the club shaft. The insert is made of a material comprising a flexible polymer. The insert reduces the torsional forces due to a club head attached to the club head end of the club shaft during use of the golf club. In a variation, an exterior dimension of the insert is less than or equal to an interior dimension of the club shaft.

Additionally, in accordance with at least several embodiments as further described above, a golf club shaft insert is described as comprising an insert adapted to be inserted into a club shaft, the insert having a length. The insert includes one or more contact portions adapted to contact an interior surface of the club shaft and one or more non-contact portions adapted to not contact the interior surface of the club shaft. An exterior dimension of the insert is less than or equal to an interior dimension of the club shaft the insert is adapted to fit within, whereby the insert is adapted to reduce the torsional forces due to a club head attached to the club head end of the club shaft during use of the golf club. In a variation, the insert is to be inserted proximate to a club head end of the club shaft. In another variation, the insert comprises a flexible polymer. In a further variation, the insert comprises a metal or a metal alloy.

Furthermore, in accordance with at least several embodiments as further described above, a golf club shaft insert is described as comprising an insert adapted to be inserted into a club shaft proximate to a club head end of the club shaft. The insert has a length and includes one or more contact portions adapted to contact an interior surface of the club shaft and one or more non-contact portions adapted to not contact the interior surface of the club shaft. The insert is made of a material comprising a flexible polymer, whereby the insert is adapted to reduce the torsional forces due to a club head attached to the club head end of the club shaft during use of the golf club. In a variation, an exterior dimension of the insert is less than or equal to an interior dimension of the club shaft that the insert is adapted to be inserted into.

Further additionally, in accordance with at least several embodiments as further described above, a golf club shaft insert is described as comprising an insert adapted to be inserted into a club shaft proximate to a club head end of the club shaft. A portion of an exterior of the insert is adapted to contact an interior surface of the club shaft. The insert has a length and includes non-contact portions comprising one or more channels formed within the insert, wherein each of the one or more channels extends annularly about at least a portion of an exterior surface of the insert. The insert is adapted to reduce the torsional forces due to a club head attached to the club head end of the club shaft during use of the golf club.

While the invention herein disclosed has been described by means of specific embodiments and applications thereof, numerous modifications and variations could be made thereto by those skilled in the art without departing from the scope of the invention set forth in the claims.

CLAIMS

What is claimed is:

1. A golf club shaft assembly comprising:

a club shaft (106); and

an insert (108) positioned within the club shaft (106) proximate to a club head end of the club shaft (106), the insert comprising:

one or more contact portions (116) contacting an interior surface (304) of the club shaft (106); and

one or more non-contact portions (118, 512), wherein each of the one or more non-contact portions (118, 512) do not contact the interior surface (304) of the club shaft (106);

wherein an exterior dimension of the insert (106) is less than or equal to an interior dimension of the club shaft, whereby the insert reduces the torsional forces due to a club head (102) attached to the club head end of the club shaft (106) during use of a golf club (100).

2. The golf club shaft assembly of Claim 1 wherein each of the one or more contact portions (116) extends at least a portion of a length of the insert (106).

3. The golf club shaft assembly of Claims 1 or 2 wherein each of the one or more non-contact portions (118, 512) extends at least a portion of a length of the insert (106).

4. The golf club shaft assembly of Claims 1, 2 or 3 wherein one or more of said one or more contact portions (116) comprise edges (116).

5. The golf club shaft assembly of Claims 1, 2, 3 or 4 wherein one or more of said one or more non-contact portions (118, 512) comprise facets (118).

6. The golf club shaft assembly of Claims 1, 2, 3, 4 or 5 wherein one or more of the one or more non-contact portions (118, 512) comprise channels (512) formed within the insert (510), wherein each of the channels (512) extends annularly about at least a portion of the exterior of the insert (510).

7. The golf club shaft assembly of Claim 6 wherein said each of the channels (512) is located at a different position along a length of the insert (510).

8. The golf club shaft assembly of Claims 1, 2, 3, 4, 5, 6, 7 or 8 wherein said insert (106) comprises a material selected from a group consisting of: a metal and a flexible polymer.

9. The golf club shaft assembly of Claims 1, 2, 3, 4, 5, 6, 7 or 8 wherein said insert (500) comprises a metal selected from a group consisting of: titanium, copper, aluminum and tungsten.

10. The golf club shaft assembly of Claims 1, 2, 3, 4, 5, 6, 7, 8 or 9 wherein said insert (106) includes a core (110) extending through at least a portion of a length of the insert (106).

11. The golf club shaft assembly of Claims 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 or 11 wherein said club shaft (106) comprises graphite.

12. A golf club shaft insert comprising:

an insert (108) adapted to be inserted into a club shaft (106) proximate to a club head end of the club shaft (106), the insert (108) having a length and including:

one or more contact portions (116) adapted to contact an interior surface (304) of the club shaft (106); and

one or more non-contact portions (118, 512) adapted to not contact the interior surface (304) of the club shaft (106);

wherein an exterior dimension of the insert (108) is less than or equal to an interior dimension of the club shaft (106) the insert (108) is adapted to be inserted into, whereby the insert (108) is adapted to reduce the torsional forces due to a club head (102) attached to the club head end of the club shaft (106) during use of a golf club (100).

13. The golf club shaft insert of Claim 12 wherein the insert (106) is made of a material, wherein the material is selected from a group consisting of a metal and a metal alloy.

14. The golf club shaft insert of Claims 12 or 13 wherein one or more of said one or more contact portions (116) comprise edges (116).

15. The golf club shaft insert of Claims 12, 13 or 14 wherein one or more of said one or more non-contact portions (118, 512) comprise facets (118).

16. The golf club shaft insert of Claims 12, 13, 14 or 15 wherein one or more of the one or more non-contact portions (118, 512) comprise channels (512) formed within the insert (106), wherein each of the channels (512) extends annularly about at least a portion of the exterior of the insert (106).

17. A method comprising:

providing a club shaft (106) having an interior surface (304) and an interior dimension;

providing an insert (108) having a length and an exterior dimension. the insert (108) including:

one or more contact portions (116); and

one or more non-contact portions (118, 512); and

inserting the insert (108) into a club head end of the club shaft (106) such that each of the one or more contact portions (116) contacts a portion of the interior surface (304) of the club shaft (106) and each of the one or more non-contact portions (118, 512) does not contact the interior surface (304) of the club shaft (106), wherein the exterior dimension of the insert (106) is less than or equal to the interior dimension of the club shaft (106), whereby the insert (108) reduces the torsional forces due to a club head (102) attached to the club head end of the club shaft (106) during use of a golf club (100).

18. The method of Claim 17 further comprising adhering the insert (108) into the club shaft (106).

19. The method of Claims 17 or 18 further comprising securing said club shaft (106) into a hosel (104) of the club head (102).

20. A golf club shaft assembly comprising:

a club shaft (106); and

an insert (108) positioned within the club shaft (106) proximate to a club head end of the club shaft (106). the insert comprising:

one or more contact portions (116) contacting an interior surface (304) of the club shaft (106); and

one or more non-contact portions (118, 512), wherein each of the one or more non-contact portions (118, 512) do not contact the interior surface (304) of the club shaft (106);

wherein the insert (108) comprises a flexible polymer, whereby the insert reduces the torsional forces due to a club head (102) attached to the club head end of the club shaft (106) during use of a golf club (100).

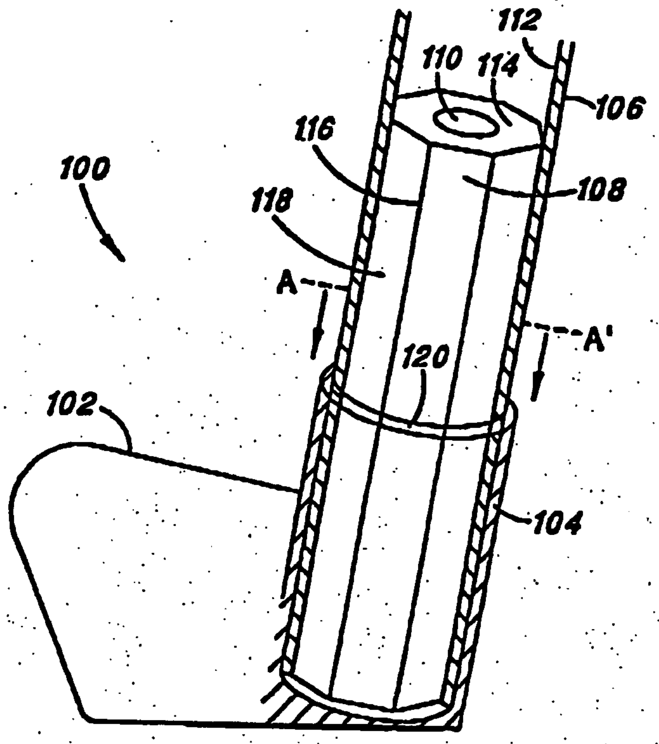

FIG. 1

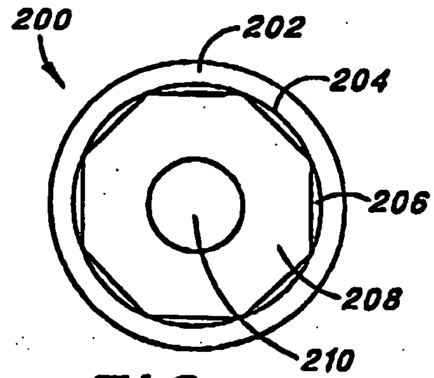

FIG. 2

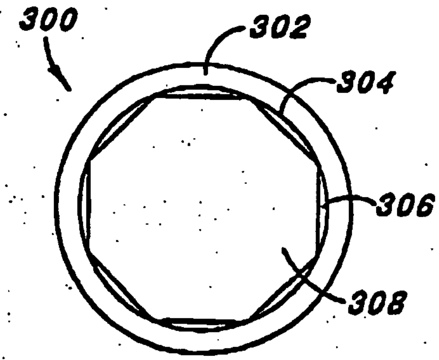

FIG. 3A

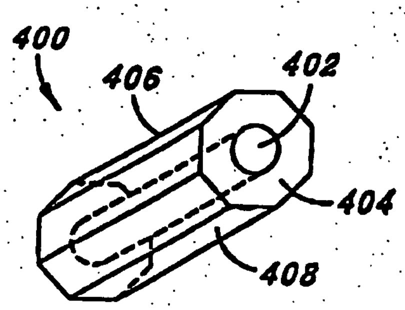

FIG. 4

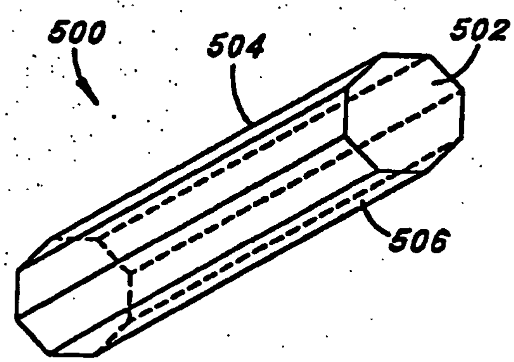

FIG. 5A

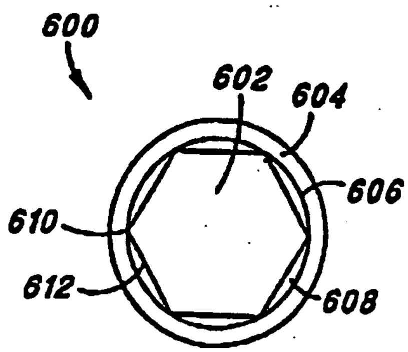

FIG. 6

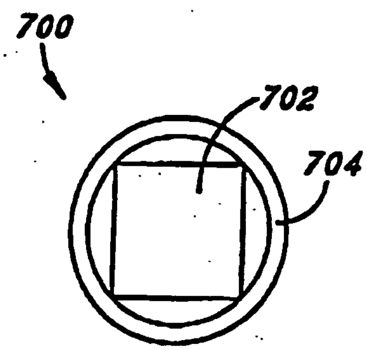

FIG. 7

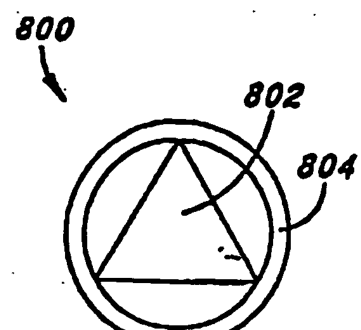

FIG. 8

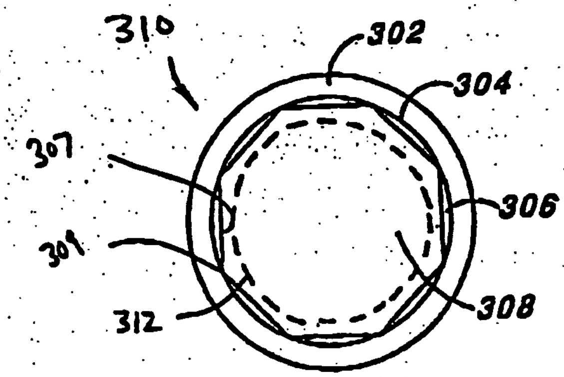

FIG. 3B

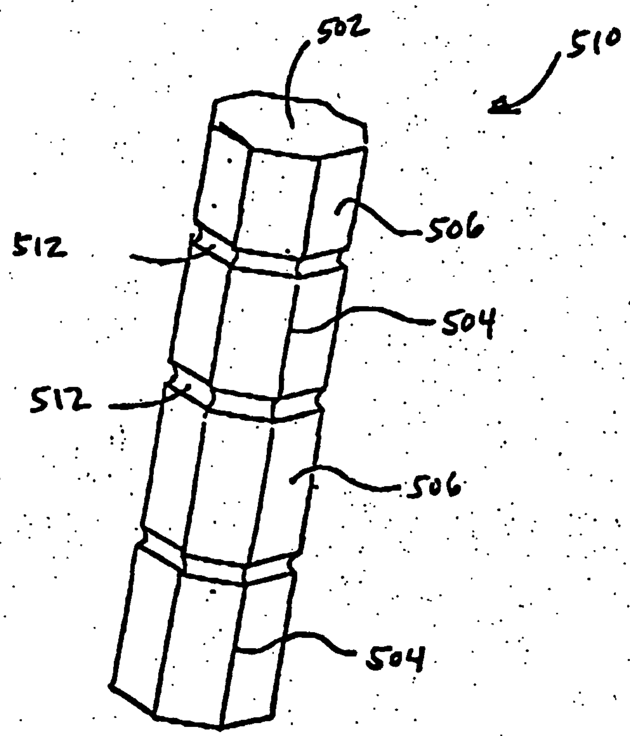

FIG 5B

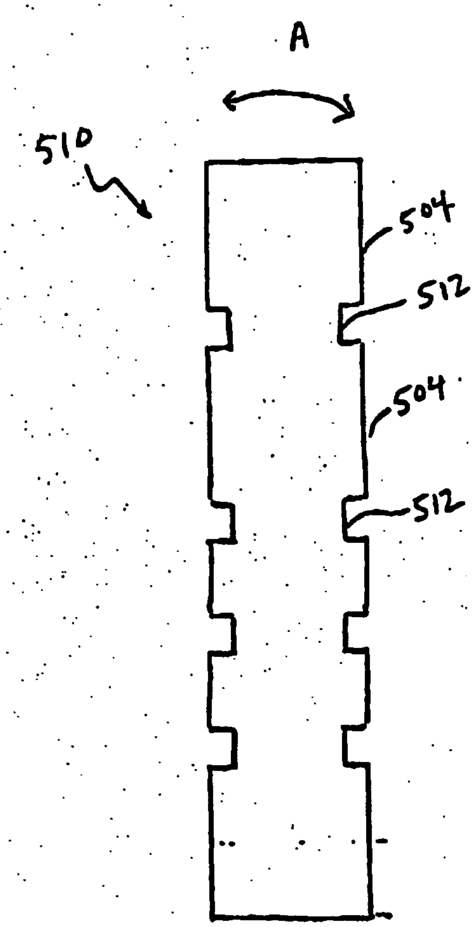

FIG. 5C

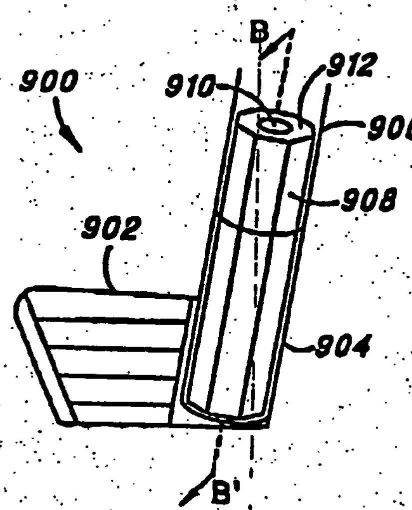

FIG. 9

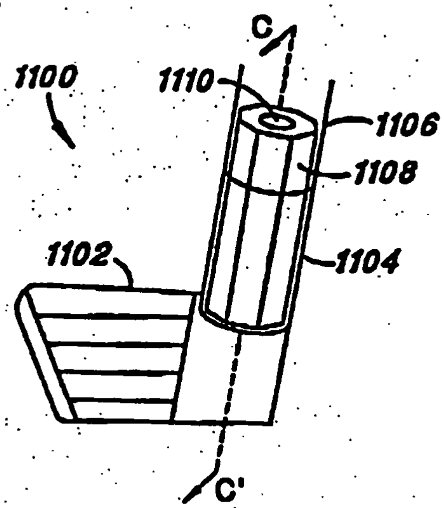

FIG. 11

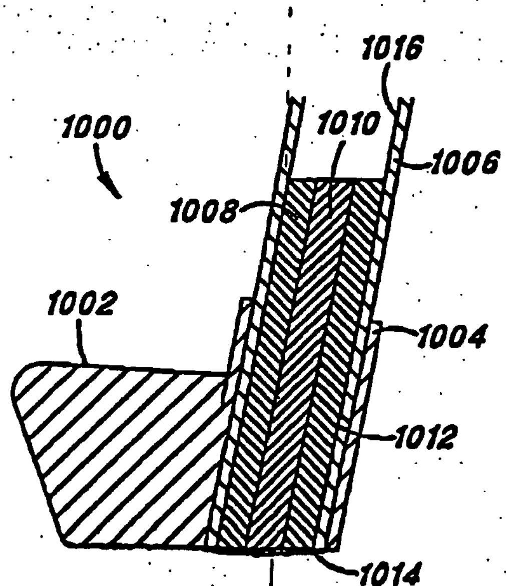

FIG. 10

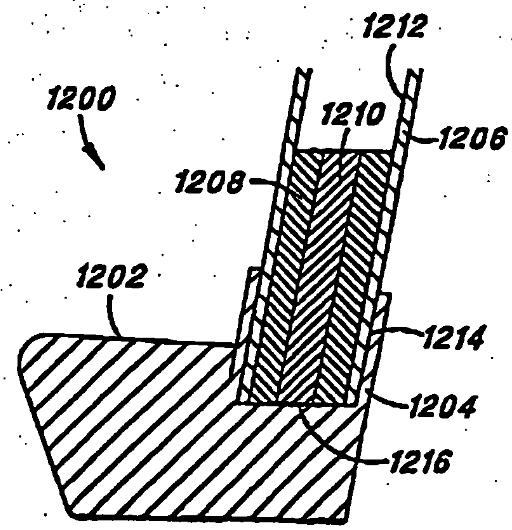

FIG. 12

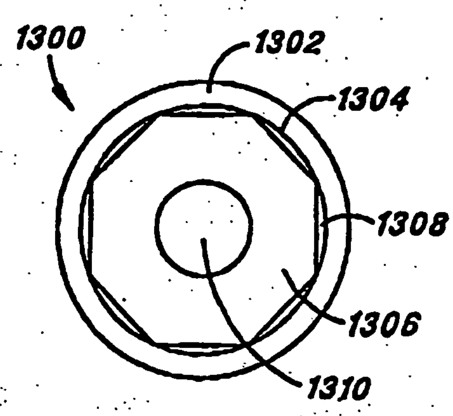

FIG. 13

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/10790

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :A63B 53/10
US CL : 473/318, 320
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 473/318, 320, 316, 317, 319, 321, 322, 323, 520

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WEST:insert, weight, shaft, polygon, hexagon, triangle, square, block, shape

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X — Y	US 5,788,586 A *(MACIOCE)* 04 August 1998, See col. 3, lines 21 through col. 4, line 21.	1-3,10, and 17-20 ------- 11
X	US 1,916,963 A *(BUHRKE ET AL.)* 04 July 1933, See figures 3-7, page 2, lines 38-50.	1, 4-5, 9, and 12-15
Y	US 5,308,062 A *(HOGAN)* 03 May 1994, See col. 4, lines 10-30.	11
X, P	US 6,042,485 A *(CHENG)* 28 March 2000, See col. 4, lines 3-52, col. 5, lines 37-65, figures 5,7.	1-4, 6-10, 12-14,16-17, and 19-20

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 JUNE 2000	13 JUL 2000

Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer for STEPHEN LUTHER BLAU Sheila Veney Paralegal Specialist Technology Center 3700 Telephone No. 703-308-0858

Form PCT/ISA/210 (second sheet) (July 1998)★